UNIVERSITY OF CALIFORNIA PUBLICATIONS

COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
BERKELEY, CALIFORNIA

HOG CHOLERA AND PREVENTIVE SERUM

BY

F. M. HAYES

BULLETIN No. 229

BERKELEY, CALIFORNIA, AUGUST, 1912

FRIEND WM. RICHARDSON, SUPERINTENDENT OF STATE PRINTING
SACRAMENTO, CALIFORNIA
1912

BENJAMIN IDE WHEELER, President of the University.

EXPERIMENT STATION STAFF.

E. J. WICKSON, M.A., Director and Horticulturist.

E. W. HILGARD, Ph.D., LL.D., Chemist (Emeritus).

W. A. SETCHELL, Ph.D., Botanist.

LEROY ANDERSON, Ph.D., Dairy Industry.

M. E. JAFFA, M.S., Nutrition Expert.

R. H. LOUGHRIDGE, Ph.D., Soil Chemist and Physicist (Emeritus).

C. W. WOODWORTH, M.S., Entomologist.

RALPH E. SMITH, B.S., Plant Pathologist and Superintendent of Southern California Pathological Laboratory and Experiment Station.

F. R. MARSHALL, B.S.A., Animal Industry.

G. W. SHAW, M.A., Ph.D., Experimental Agronomist and Agricultural Technologist, in charge of Cereal Stations.

B. A. ETCHEVERRY, B.S., Irrigation Expert.

F. T. BIOLETTI, M.S., Viticulturist.

W. T. CLARKE, B.S., Assistant Horticulturist and Superintendent of University Extension in Agriculture.

JOHN S. BURD, B.S., Chemist, in charge of Fertilizer Control.

J. E. COIT, Ph.D., Pomologist, Riverside.

C. B. LIPMAN, Ph.D., Soil Chemist and Bacteriologist.

GEORGE E. COLBY, M.S., Chemist (Fruits, Waters, and Insecticides), in charge of Chemical Laboratory.

H. J. QUAYLE, M.S., Assistant Entomologist.

H. M. HALL, Ph.D., Assistant Botanist.

C. M. HARING, D.V.M., Veterinarian and Bacteriologist.

E. B. BABCOCK, B.S., Agricultural Education.

W. B. HERMS, M.A., Assistant Entomologist.

W. T. HORNE, B.S., Assistant Plant Pathologist.

L. M. DAVIS, B.S., Assistant Dairy Industry.

W. W. BONNS, M.S., Assistant Pomologist.

A. J. GAUMNITZ, M.S., Assistant Agronomist, University Farm, Davis.

T. F. HUNT, B.S., Assistant Plant Pathologist.

F. L. McCREARY, B.S., Chemist in Fertilizer Control.

E. H. HAGEMANN, Assistant in Dairying, Davis.

R. M. ROBERTS, Farm Manager, University Farm, Davis.

J. I. THOMPSON, B.S., Assistant Animal Industry, Davis.

J. C. BRIDWELL, B.S., Assistant Entomologist.

L. BONNET, I.A., Assistant Viticulturist.

F. C. H. FLOSSFEDER, Assistant in Viticulture, University Farm, Davis.

P. L. HIBBARD, B.S., Assistant Fertilizer Control Laboratory.

C. H. McCHARLES, M.S., Assistant Agricultural Chemical Laboratory.

B. A. MADSON, B.S.A., Assistant Experimental Agronomist.

WALTER E. PACKARD, M.S., Field Assistant Imperial Valley Investigation, El Centro.

S. S. ROGERS, B.S., Assistant Plant Pathologist, Plant Disease Laboratory, Whittier.

C. O. SMITH, M.S., Assistant Plant Pathologist, Plant Disease Laboratory, Whittier.

E. H. SMITH, M.S., Assistant Plant Pathologist.

C. L. ROADHOUSE, D.V.M., Assistant in Veterinary Science.

F. M. HAYES, D.V.M., Assistant Veterinarian.

P. S. BURGESS, M.S., Assistant Soil Chemist.

W. F. GERICKE, B.S., Assistant Soil Chemist.

M. E. STOVER, B.S., Assistant in Agricultural Chemical Laboratory.

W. H. VOLCK, Field Assistant in Entomology, Watsonville.

E. L. MORRIS, Field Assistant in Entomology, San José.

E. E. THOMAS, B.S., Assistant Chemist, Plant Disease Laboratory, Whittier.

A. B. SHAW, B.S., Assistant in Entomology.

G. P. GRAY, M.S., Chemist in Insecticides.

H. D. YOUNG, B.S., Assistant in Agricultural Chemistry, Plant Disease Laboratory, Whittier.

A. R. TYLOR, B.S., Assistant in Plant Pathology, Plant Disease Laboratory, Whittier.

W. V. CRUESS, B.S., Assistant in Zymology.

J. F. MITCHELL, D.V.M., Assistant in Veterinary Laboratory.

W. A. BOYS, B.S., Assistant Cerealist.

M. R. MILLER, B.S., Assistant Chemist in Insecticides.

F. H. WILSON, B.S., Assistant in Soil Chemistry.

W. M. MERTZ, Assistant in Pomology, Riverside.

ANNA M. LUTE, A.B., Scientific Assistant, U. S. Dept. of Agriculture.

J. C. ROPER, Patron, University Forestry Station, Chico.

E. C. MILLER, Foreman, Forestry Station, Chico.

D. L. BUNNELL, Secretary to Director.

HOG CHOLERA AND PREVENTIVE SERUM.

Hog cholera has for many years been the greatest menace facing the swine industry. Were it not for this disease, hog raising would be one of the most profitable branches of the live stock business. Those who have escaped its effects are indeed fortunate. Next to tuberculosis in hogs more hogs have been condemned for hog cholera under federal inspection than for any other cause. However, this does not give any fair idea of the loss from hog cholera, because it is only a few of such affected hogs that ever live to reach the abattoir, while the tuberculous hogs may not show evidence of tuberculosis until slaughter. It may be estimated that 85 per cent of all the losses from death or lack of proper development in hogs, are produced by hog cholera. California does not produce sufficient pork to supply the domestic demand. Not all of the territory comprising the State is by any means suitable to the hog industry; but, nevertheless, there is opportunity for a great increase in the production of hogs under present conditions, and with the development of new territory through the introduction of irrigation, this should be one of the most profitable branches of stock raising. That California is not raising a proportionate number of hogs is no doubt influenced by losses that have occurred because of hog cholera. The Experiment Station receives many letters every day from hog-raisers of the State, asking information concerning this disease, its symptoms and treatment. This bulletin is prepared to supply such information as will enable the farmer to familiarize himself with the symptoms of hog cholera, the principles of sanitation before and during outbreaks, and the use of anti-hog cholera serum, so that the disease may be prevented, or at least early cases recognized, and appropriate measures taken to prevent extensive dissemination.

Cause of hog cholera.

The specific cause of hog cholera is a germ so small that it can not be seen by use of a microscope. The organisms pass through the finest filters and cannot be artificially grown in the laboratory. The blood and excretions, especially the urine and feces of a hog sick with cholera, are capable of producing the disease in a susceptible hog. The virus (blood of a sick hog) is highly infectious.

The accessory causes of hog cholera are numerous and include all conditions that weaken the constitution and natural resistance to disease, such as: (1) improper feeding, which includes unbalanced rations, over feeding, insufficient food, irritating food—as garbage and fermented slops are likely to be—and insanitary feeding troughs and

floors; (2) impure drinking water. A hog requires clean water just as much as any animal. Stagnant, warm and dirty water in which the hog bathes should not be given him to drink. This may be conservation of water but not of health; (3) insufficient protection from the heat in summer and from the cold and dampness during the winter brings about disorders that may render a hog susceptible to cholera; (4) insanitary condition of yards, houses and farrowing pens. Many forms of bacterial life develop in insanitary environment. Lice and worms are a menace to the health of the hog; (5) crowding hogs in sleeping quarters causes unhealthy conditions. Hog cholera cannot be produced except through infection with the specific virus, but these accessory causes increase the susceptibility to this virus.

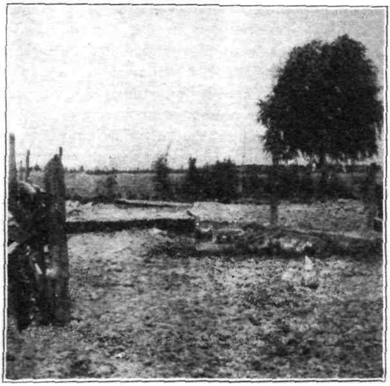

FIG. 1.—Insanitary hogpen and wallow.

Period of incubation and susceptibility.

The period of incubation, which is the time between the exposure to the disease and the appearance of symptoms, may vary from four days to two weeks, depending upon the virulence of the infecting material and the natural resistance of the hogs. Young hogs are more susceptible to cholera than older hogs. Fat hogs which are heavily fed and closely penned show less resistance than other types. All breeds of hogs, including the mule-foot, are about equally susceptible to cholera, though individuals in any herd are occasionally found to be immune. The disease may be very acute at the beginning of an outbreak and the infecting material become less virulent after passing through several animals.

Symptoms.

Although the symptoms of hog cholera vary in different outbreaks and in different individuals in the same herd, due no doubt to varying conditions of feeding, watering, handling, climate, season, housing, natural resistance, and mixed infections, there are a few symptoms of which the hog raiser may be suspicious and lesions of which he may be certain.

The most common symptoms are loss of appetite, lassitude, and a disposition to lie with the head under the litter. There is no desire to follow the herd in feeding. The back may be arched and the bristles erected. Accompanying this there may a cough and a discharge from the eyes and nose. In dusty pens, or if the hog has access to muddy

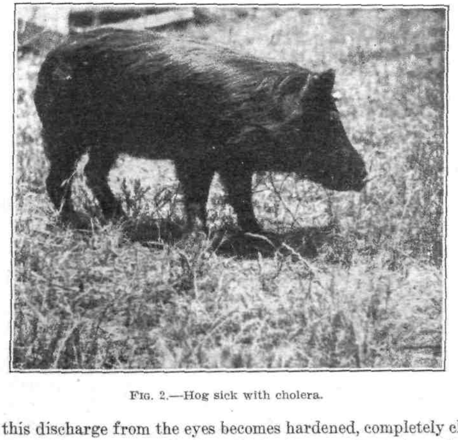

FIG. 2.—Hog sick with cholera.

water, this discharge from the eyes becomes hardened, completely closing the eyes, and causing an irritation which often results in loss of sight. During this time the bodily temperature has risen; constipation, or diarrhœa, usually of a yellowish color, is present, and the hog has difficulty in supporting himself upon his hind legs, swaying from side to side as he attempts to walk. His head and ears hang down, exhibiting the general appearance of little energy.

Inflammation of the ears and skin with extensive sloughs rarely occurs. Heart beats and respirations are usually quickened. The breathing may be very labored in cases where the lungs and lining of the chest cavity are diseased. In the acute form, which lasts from a

few days to a week, the skin along the belly and behind the ears and between the thighs often shows a purplish red discoloration. The chronic form may show all of the symptoms of the acute type but in a less degree, and may continue from two weeks to two months, sometimes ending in recovery.

Post-mortem appearance.

All farmers should either post-mortem every hog that dies under circumstances at all suspicious, or have the work done by a competent veterinarian who should be able to recognize any lesions indicating the presence of an infectious disease in the herd. These conditions, if recog-

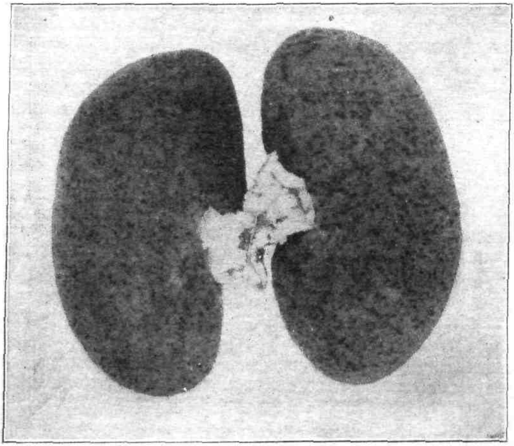

FIG. 3.—The appearance of the kidneys in some cases of hog cholera.

nized early and proper methods of isolation instituted, might prevent the general dissemination of the disease throughout the herd.

In cases of hog cholera the lesions will vary according to the course of the disease, but the following are usually present: Slight inflammation of the bladder is shown by redness of its lining; hæmorrhagic spots on the kidneys varying in size from the point to the head of a pin. The kidneys are often pale and light colored showing these black spots, but may be dark and congested. The kidneys may be thickly covered with these spots, or possibly only a few of them may be seen by stripping off the envelope of the kidney. The kidneys sometimes resemble a

turkey egg in appearance. The spleen is usually enlarged, congested, black and friable. Inflammation of the intestines, more especially the mucous membrance of the cæcum, the beginning of the large intestine, often occurs. This inflammation may be diffuse or in the form of ulcers, depending upon whether the acute or the chronic type of the disease exists. The presence of button-shaped ulcers in the large intestines is the best indication of chronic cholera. The outer covering of the intestines may show red blotches in the acute type. Diffuse inflammation of the inner surface of the stomach, congestion of the lymphatic glands along the intestines and between the lungs, hæmorrhagic spots on the lungs varying from one eighth inch to entire congestion of all the lobes with accompanying loss of function, are frequently seen.

In the highly acute form the lungs may show very little change except possibly a few red spots. In the less acute form parts of the lung resemble liver tissue and in chronic cases may be filled with pus with adhesions to the chest walls. Inflammation of the covering of the heart may also exist. Examination for these changes should be made as soon as possible after death of the animal. Diagnosis may be made more certain by destroying a very sick pig and making an immediate examination.

In making post-mortems a quantity of disinfectant should always be near by so that the hands may be disinfected thoroughly after the operation or in case of accidental cuts, immediately, to prevent blood poisoning or other infection.

The following table shows the organs which should be examined when hog cholera is suspected. A description of the appearance of the organs in cases of cholera is given after each organ. It must be remembered that all of these post-mortem appearances may not be found in one hog. Those in the skin, large intestine, small intestine, spleen, kidneys and lungs are the most diagnostic.

Skin	Red or purple discoloration along belly and between the hams. Ulcers may appear and the skin crack and ears slough.
Large intestines	External congestion and internal congestion with hæmorrhagic spots in the acute form, and ulcers in chronic cholera.
Small intestines	External and internal congestion. Sometimes hæmorrhagic spots. Seldom ulcers.
Kidneys	Pale or dark in color, with reddish-black spots on the external surface. May resemble a turkey egg in appearance.
Spleen	Enlarged, black, friable. Sometimes resembles black jam.
Liver	Seldom any visible changes. May be enlarged and congested.
Stomach	Congestion on mucous lining in varying degrees.
Bladder	Congestion and hæmorrhagic spots on mucous surface.
Lymphatic glands	Varying degrees of congestion, from pink to dark in color.
Lungs	May be covered with hæmorrhagic spots of red or brown color varying in size from a pin head to a half dollar. Complete hardening of parts of the lung occurs. Pus may form, and adhesions to the chest wall sometimes take place.
Heart	Sometimes shows small areas of congestion of the base.

How hog cholera spreads.

It is important to remember that hog cholera is highly infectious and that all of the excretions of the sick hog are capable of producing the disease. For this reason there are many ways by which the disease is scattered and may be avoided. The manure of the sick hog is perhaps largely responsible for the rapid spread of the disease, since this excrement contaminates the pens, houses, and feeding floors, and is in contact with the hogs at all times. Various animals as dogs, rabbits, cats, coyotes, buzzards, crows, pigeons, and other birds, may carry the germs to another herd. Often when a hog dies the owner thinks little of it and the carcass is allowed to remain in the pen to be eaten by the other hogs. Or the carcass is left in the field as a prey to other meat-eating animals. This hog may have been the first to be infected and die of hog cholera, and by this method of disposition the seed is sown for a good crop of cholera in the neighborhood. In known outbreaks carelessness in disposition of dead carcasses may result in useless spread of the disease. The germs may be carried on the shoes or clothing of any one handling the hogs, to herds subsequently visited. Stock cars used for shipping hogs are to be considered cholera infected unless thoroughly cleaned and disinfected, as are also public stockyards. It is dangerous for the farmer to frequent these places and return to attend to his own herd without first disinfecting at least his shoes. Show hogs may bring the germs of *the disease to the farm upon their return. For this reason they should* be held in quarantine at least two or three weeks before being allowed *to run with other hogs. Streams of water receiving drainage from* infected pens are fruitful ways of carrying the germs of the disease *to the other herds which receive water from such sources.* Wagons often used to carry away dead hogs may be unthinkingly used to haul well and susceptible hogs. Frequently, apparently well hogs are purchased, and in a few days begin to show symptoms of cholera. If they have been placed immediately with other hogs, a general outbreak may be expected. Knowing the source of the cholera germs from the sick hogs, the intelligent use of this knowledge may prevent extensive outbreaks.

Sanitary law relating to animals.

In general, the sanitary laws of the State provide that all contagious diseases in animals must be reported to the State Veterinarian at Sacramento. It is a misdemeanor to allow infected hogs to run at large. *It is a violation of the law not to dispose of carcasses of hogs dead from cholera, in such a manner as will prevent the spread of the disease.*

General preventive and hygienic measures.

These may include measures to prevent not only the introduction of hog cholera but also further extension of the disease. All that is necessary to prevent cholera is to keep the hogs from coming in contact with the specific virus. Sources of infection should then of course be avoided. New stock purchased ought to be held in quarantine at least two or three weeks to give time for the evidence of symptoms should the hogs be infected. Pens should not be located near public roads where hogs may be driven. Care should be exercised in allowing visitors to come in contact with the yards and hogs.

The general health of the hogs must be considered a factor in the prevention or occurrence of cholera. The healthy herd, well cared for, will often resist the disease when other hogs, not so well attended, will contract it. Clean pens, pure drinking water, clean feeding places, proper feed and care, are factors working against infection. Plenty of room, in dry, well ventilated houses for sleeping quarters should at all times be provided. The yard should be well drained.

The lousy hog is more susceptible to cholera because lice weaken the general health of the affected animal. Hogs should be dipped twice at intervals of ten days, every six months. The pens, hog houses, and troughs should be frequently cleaned of all litter and refuse, and strong solutions of one of the various dips sprayed upon the premises.

A tonic powder composed of the following may improve the general health:

Wood charcoal	1 part
Oil meal	5 parts
Copperas	2 parts
Salt	1 part
Sulphur	1 part

The powder may be given in doses of one tablespoonful to each hundred pounds of hogs, once a day in the feed.

When cholera has already appeared in the herd there is little to be done by treatment with drugs. There is no known specific treatment for the hog sick with cholera. If the money that is spent for the various hog cholera "cures" that are on the market, were spent toward the improvement of the hygienic conditions and care of hogs, there would be fewer sick hogs upon which to use the "cures" and more money in the pocket of the swine raiser. It seems to be characteristic of a large part of the hog raisers to give a trial to all of the "specifics" that are presented for sale by various companies, instead of applying to the State Experiment Station and state authorities interested in, and working toward, the preservation of the health of animals, for information regarding such products. The State Experiment Station at all times desires and expects to give whatever advice possible.

Hygienic measures are important in checking outbreaks of hog cholera. Dip the well hogs, separate them from the sick hogs, and move them to clean quarters at the appearance of the disease. All dead hogs should be burned, or covered with lime and buried six feet deep. It is better to burn because there is then no opportunity for the carcass to be uncovered and infect the premises. If possible, the well and sick hogs should have different attendants and the utensils of the sick should not be used in feeding the well hogs. Cresol compound, U. S. P. (1–20) or strong solutions of dips should be sprayed around the premises after the pens and houses have been cleaned. The liberal use of disinfectants, with perhaps a little in the feed, will do much toward reducing the virulence in the sub-acute type. It is not advisable to feed the sick hogs on a heavy ration. Feed them slops of some ground feeds. Good range in good weather is desirable but this infects too large a territory that is difficult to disinfect. After the disease has run its course the infected pens should be again thoroughly disinfected and lime scattered on the premises. Whitewashing will do much toward destroying the germs.

Fields may be plowed and sowed to some forage crop or they may be left free from hogs for a few months. It is not safe to place susceptible hogs in infected pens within three months after the disease has disappeared, and even then new infection may occur unless the disinfection has been very thorough.

PREVENTION OF CHOLERA BY HYPER-IMMUNE SERUM.

The great loss that has been yearly sustained by the hog industry through the ravages of hog cholera has been the cause of much investigation directed toward the cure and prevention of the disease. Measures directed toward the *cure* of hog cholera have been practically fruitless, but to Drs. Dorset and Niles of the United States Bureau of Animal Industry belongs the credit of developing and making practical the use of a hyper-immune serum to prevent hog cholera. Soon after field tests of this serum had proved its efficiency, various state experiment stations undertook its preparation through state appropriations.

In response to a demand by the swine raisers of California, the following bill was prepared and passed by the State Legislature in 1911:

An act to provide for the preparation and distribution of serums or vaccines for the prevention of the disease known as cholera in hogs in the State of California, making an appropriation therefor and prescribing the duties of the Controller and Treasurer in relation thereto.

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. The Regents of the University of California are hereby directed to cause to be prosecuted with all possible diligence, through the Agricultural Experi-

ment Station, the preparation of serums or vaccines that will produce immunity in hogs against the disease known as cholera.

SEC. 2. The Regents of the University of California are hereby further authorized and directed to furnish such serums or vaccines in quantities not exceeding five hundred cubic centimeters as soon as possible after this act takes effect free of charge to any bona fide resident of the State of California who is engaged in the raising of hogs, upon application by such bona fide resident hog raiser.

SEC. 3. The Regents of the University of California are also hereby further authorized and directed to furnish any bona fide resident of this State, who is engaged in the raising of hogs, such serums and vaccines in quantities in excess of five hundred cubic centimeters, upon the applicant paying therefor the actual cost of production of such serums or vaccines.

SEC. 4. It is herewith provided that no serums or vaccines shall be furnished free of charge to any one unless the applicant shall have first furnished sufficient evidence that the disease known as cholera exists among his hogs or among the hogs in his immediate neighborhood, and in such case evidence shall be furnished by said applicant that there is danger of the disease being communicated to the applicant's hogs.

SEC. 5. Any person who shall sell, give away, or misuse any of the serums so furnished shall, upon conviction thereof be deemed guilty of a misdemeanor, and be punished as in such cases provided by law.

SEC. 6. The Director of the Agricultural Experiment Station shall obtain and establish such assistance, equipment, materials, appliances, apparatus, and other necesary incidentals as may be necessary to the successful prosecution of this work within the appropriation herein specified.

SEC. 7. The sum of sixteen thousand ($16,000.00) dollars is hereby appropriated out of any money in the state treasury, not otherwise appropriated, six thousand ($6,000.00) dollars of which shall be available for the balance of the sixty-second fiscal year and ten thousand ($10,000.00) dollars of which shall be available during the sixty-third and sixty-fourth fiscal years for the use of said Experiment Station to be expended by the Regents of the University of California in carrying out the purposes of this act, and the State Controller is hereby authorized and directed to draw his warrant for the same, and the State Treasurer is hereby directed to pay such warrant.

SEC. 8. All money appropriated under this act, and all money received for the sale of said serums or vaccines as provided for in section three of this act, shall be paid to the Regents of the University of California, and shall be expended under the direction of the Director of the Agricultural Experiment Station of said University for the specific purposes herein named.

Six thousand dollars ($6,000.00) of the appropriation became available June 21, 1911, but to expedite the work of establishing the serum plant, the Regents of the University of California advanced three thousand dollars ($3,000.00) soon after the Governor signed the bill and the work of preparation was prosecuted with all possible diligence.

How the serum is produced.

Hogs which are naturally immune to cholera or are immune through having had the disease and recovered, are protected against the cholera by virtue of the presence in their blood of invisible substances known as "anti-bodies" which are antagonistic to the specific cause of cholera. These anti-bodies do not exist in the simply immune hog in sufficient quantities to protect susceptible hogs should they be treated with blood from the immunes, unless very large quantities of blood should be used. To increase the amount of these anti-bodies in the blood of the immune hog, the hog is injected with quantities of virulent hog cholera blood, which stimulates the cells of the body to throw off a

larger amount of anti-bodies. The process is known as hyper-immun izing, and the hog so treated, as the hyper-immune. The hyper-immun furnishes the serum which is used to protect susceptible hogs. Fo this purpose vigorous hogs weighing from 150 to 300 pounds ar used. If they are not already immune these hogs must be treate with a small quantity of hog cholera virus and the protective serum To test the immunity from this treatment, a preliminary dose of ho cholera virus is injected into these pigs in about ten days after th protective dose. In ten days more these are ready to be made hyper immune. This process may be carried on in several different ways.

In the intra-venous method one injection of 5 c.c. to the pound o hog, of virulent hog cholera blood is injected into a vein in the ear A 200 pound hog requires a quart at one injection by this method.

In the intra-abdominal method, one injection of about 8 c.c. to th pound of hog is injected into the abdominal cavity.

In the subcutaneous method, one injection of 10 c.c. per pound o hog is injected underneath the skin.

In the slow subcutaneous three injections are given at intervals o one week at the rate of 1 c.c. per pound at the first, 3 c.c. per poun at the second, and 5 c.c. per pound at the third injection. In abou ten days after treatment by any of these methods, the hyper-immun is ready to be bled the first time and thereafter at intervals of on week until four bleedings have been taken. Bleeding of the hyper immune is accomplished by cutting off a small portion of his tail a each bleeding. The flow of blood is stopped by a string ligatur around the end of the tail. After four bleedings the hyper-immun may be rehyper-immunized. Bleeding and hyper-immunizing may b continued as long as there is tail remaining. When the hog canno be bled longer from the tail, all of the blood is taken by severing th jugular vein or carotid artery. These hogs are fit for food, subjec of course to post-mortem inspection for abnormal conditions. After the blood is drawn from the tail the clot is removed, the blood serum and corpuscles that remain are mixed with carbolic acid solution to one-half per cent acid. A 200 pound hyper-immune may furnish from 1000 to 1200 c.c. of serum at one bleeding.

The serum must be stored in a cool place at a temperature not above 55° F. Serum kept in a cold place will remain potent for a year or more.

In order to obtain the large quantity of hog cholera virus that is necessary to produce the hyper-immune, young and healthy susceptible shotes weighing from 50 to 100 pounds are injected with virus and should be ready to be killed, and their blood collected at the most virulent stage of acute cholera, in from seven to fifteen days. Inoculated shotes that linger longer than fifteen days usually develop the

chronic form of cholera, and such blood does not produce potent serum. The virulent blood must be collected and handled in the most careful manner to prevent contamination with germs that may kill the hyper-immune into which the blood is injected. Virulent blood

FIG. 4.—Bleeding a sick hog to obtain cholera blood (virus) for hyper-immunizing.

used for hyper-immunizing, must not be over twenty-four hours old and must be stored in a cool place if not used immediately.

The addition of one half per cent carbolic acid solution does not destroy the hog cholera virus. This has been demonstrated in the

laboratory and is of considerable value in collecting hog cholera blood from outbreaks when the virus cannot be used immediately. Virus collected in the field and preserved in this way may be used with safety in the slow subcutaneous method of hyper-immunizing. Virus used for simultaneous inoculations should contain from one-fourth to one-half per cent carbolic acid to prevent septic infection. Experiments are in progress in using formalin as a suitable preservative for virus intended for intra-venous or intra-abdominal injections.

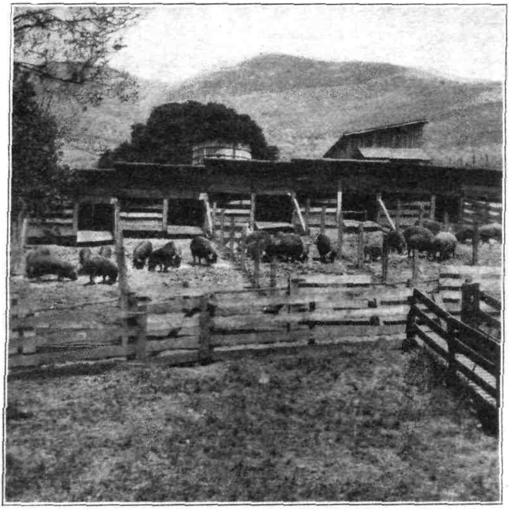

FIG. 5.—View of part of the hyper-immune pens.

Potency of serum.

All serum distributed by the California Station is carefully tested for potency before it is sent from the laboratory. This is done in the following manner: The blood serum of several hyper-immunes is mixed. Six pigs weighing from 50 to 100 pounds are injected intra-muscularly with 2 c.c. each of virulent hog cholera blood. Each of two of these is given 15 c.c. of the mixed sera to be tested. Two others are given 20 c.c. each of the mixed sera to be tested. If all those receiving immunizing serum continue in good health and the

two checks become ill of cholera within eight days and are apparently going to die within fifteen days, the serum is considered suitable for field use in doses of 20 c.c. for hogs weighing from 50 to 100 pounds.

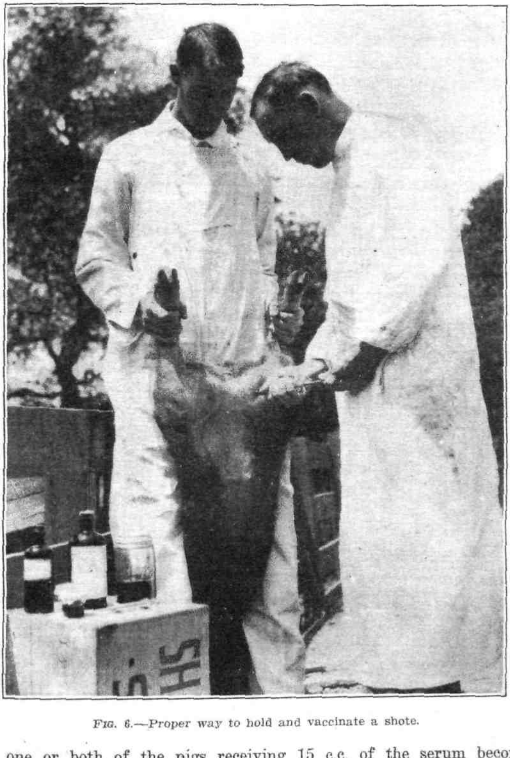

FIG. 6.—Proper way to hold and vaccinate a shote.

If one or both of the pigs receiving 15 c.c. of the serum become obviously sick of cholera and the two pigs receiving 20 c.c. each of the immunizing serum both continue in good health, then the serum may be used in field work in suitably increased doses.

Methods of using hyper-immune serum.

The success of the treatment of hogs with hyper-immune sera depends not only upon the careful and scientific method of preparation, but also upon its intelligent administration. The Experiment Station assumes no responsibility for the results of the use of the sera which it distributes. It is recommended that wherever possible competent and qualified veterinarians should be engaged to administer the serum. However, an intelligent hog owner, by observing strict attention to directions which are sent with orders for serum, may expect satisfactory results from the treatment with protective serum.

The serum is a *preventive*, not a *cure*, for hog cholera, and should not be given to hogs already sick with cholera. It is a preventive to hog cholera *only*, and cannot be expected to prevent hogs from becoming sick from other conditions. A correct diagnosis is therefore demanded to protect the serum, and prevent its useless administration in herds sick from some other cause.

There are two methods of using hyper-immune serum, viz., the "Serum Alone" and the "Serum Simultaneous."

Serum alone.

This method is recommended to be used in an already infected herd, upon apparently healthy hogs *only*. Inject deeply into the muscles of the inside of the ham the proper dose of *serum* only. This method gives only temporary immunity, lasting from six weeks to three months if the hog is not exposed to infectious material in the mean time. Should the immunized hog be immediately exposed to infection after treatment the result would be a more permanent immunity conferred.

This method is also useful in giving temporary immunity to valuable pure bred hogs before shipping to fairs.

Although it may be desirable to allow the treated hogs to mix with the diseased because of a possibility of a longer immunity being conferred, it must not be overlooked that so long as the sick hogs are *not* destroyed and the infected pens are *not* disinfected, there is a center existing for continuous opportunity for the infection to be carried to other parts of the neighborhood. It is further advised that if disinfection of the pens and destruction of the sick hogs are not carried on at the *beginning* of an outbreak, that it certainly be done as soon as the herd shows evidence that the disease is checking, because of the possibility that the treated hogs have not been sufficiently exposed to the infected material during the outbreak to give them a longer immunity than the serum-alone treatment might have given them, which is probably from six weeks to three months.

All immunized hogs should, however, either be kept separate from the untreated or be marked in some way so that the results of the

serum may be accurately known. Before treatment it is *imperative* that the well hogs be kept away from the sick ones and disinfection carried on. The dead hogs should at all times be immediately burned.

FIG. 7.—A method of vaccinating a heavy hog.

Serum simultaneous.

This method gives a more lasting immunity but is attended with some danger, unless the treatment is administered by a person who thoroughly understands the precautions necessary. For the present only qualified veterinarians will be allowed to use this method.

This is for the purpose of minimizing any bad results. In using this method, from one-half to one cubic centimeter of virulent hog cholera blood is injected into the muscles of the inside of the ham on one side, while at the same time the proper dose of hyper-immune serum is

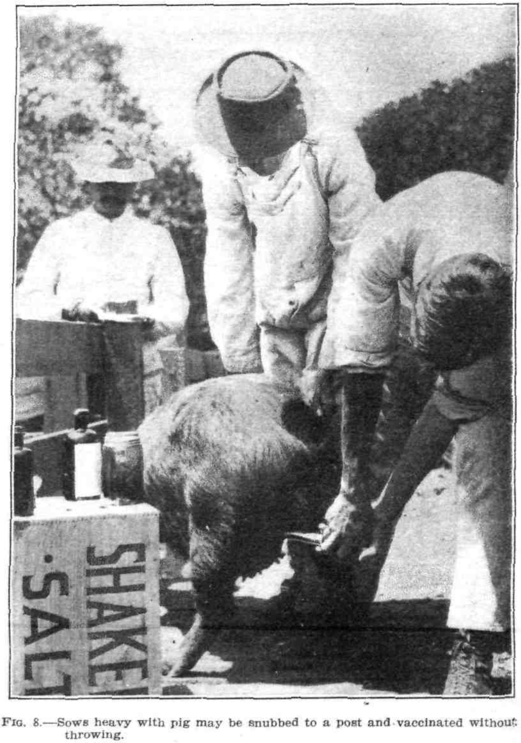

FIG. 8.—Sows heavy with pig may be snubbed to a post and vaccinated without throwing.

injected into the opposite ham, in the same manner as described under "Serum Alone." This method is recommended for non-infected herds, or it may be used upon recently infected herds, upon hogs that do not show a temperature higher than 103.5° F.

It is the method to use when the swine raiser wishes to immunize his herd when infection has not yet taken place, provided the entire herd is treated. While the loss is less than one-tenth of one per cent from this method, the entire herd must be immunized because of the danger to untreated hogs in case cholera is produced in a few of the treated hogs. Where all hogs are not treated by this method the immunized hogs should be kept in strict quarantine for two weeks to give time for development of any cases of cholera. It is valuable to use on all breeding stock because the offspring of immune sows has been shown to possess a slight immunity up to four or six weeks. After this time the pigs themselves may be given a lasting immunity by this method of treatment. It is not advisable to use the simultaneous method upon pigs under six weeks of age. Wherever possible this manner of treatment should be used, but only by persons who thoroughly understand the technique and the dangers. The Experiment Station will aid in every way possible, so long as funds are available, in assisting the use of the serum and the virus. A list of qualified veterinarians is kept so that the station is able to recommend competent men who may be employed to use this treatment.

Properly prepared serum, when used alone, without the employment of blood from a sick hog, is entirely harmless and incapable of giving rise to an attack of hog cholera. Nor does this injection interfere in any way with the growth of the treated hogs.

Administering the serum.

Always act promptly upon the appearance of cholera. After the disease is well settled in the herd it does little good to vaccinate.

The inside of the ham should be thoroughly washed with a 3 per cent lysol, creolin, or carbolic acid solution before making the injection. Failure to do this may result in abscess and necrosis of the muscles.

Very heavy hogs, and sows heavy with pig, may be snubbed up to a corner and the injection made into the ham from the rear. Others may be held up by the hind legs or thrown to the ground. Figs. 6, 7, and 8 show methods of handling.

All instruments and glassware used in the treatment must be previously sterilized by boiling. The syringe should be kept in disinfectant while not in actual use in injecting serum.

Avoid sticking the bone in making injections. A short, stout, slip needle on the syringe will help to prevent this accident, and also reduce the possibility of breaking the needle.

Open only one bottle of serum at a time. If it is necessary to keep the serum for a time before using, it should be kept in a cool, dark place or upon ice.

Vessels containing serum and virulent blood should be kept covered during the operation to prevent contamination from the air and dust.

Do not use *serum* for *virus* or *virus* for *serum*.

Do not underestimate the weight of the hog to save serum. A small amount may not protect while an overdose does no harm.

Should any virulent blood be spilled during the operation, immediately cover it with disinfectant. Destroy that remaining after treatment by increasing its volume several times with a strong disinfectant.

Use separate syringes for virulent blood and serum.

Do not release the hog until the operation has been completed. The point of injection should be wiped with disinfectant and made certain that no serum or virus is oozing from the point of injection before the operation can be considered complete.

Subsequent to treatment the hogs should not be allowed to lie in muddy and filthy pens.

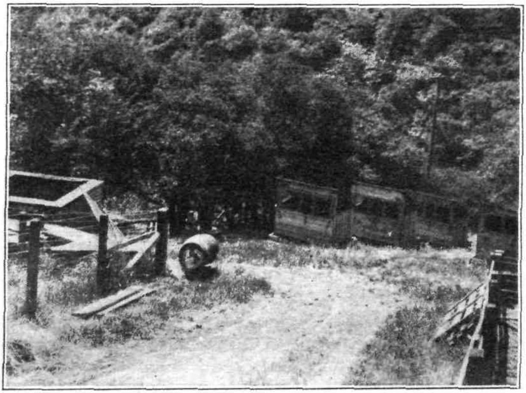

FIG. 9.—A group of virus houses for sick hogs. Incinerator at the left.

Equipment necessary.

A reliable graduated syringe holding 20 c.c. and possessing a stout, short slip needle. (These may be obtained by applying to the Director of the Experiment Station. Prices range from $2.00 to $5.00 each.)

A smaller syringe holding from 5 to 10 c.c. for use with virulent blood.

A pint Mason jar or tumbler to hold the serum.

A smaller vessel for holding virulent blood.

A quantity of disinfectant solution and a cloth.

Table of Doses.

Weight of hogs.	Dose of serum.	Dose of virus.
Sucking pigs	10 to 15 c. c.	½ c. c.
30 to 50 pounds	15 to 20 c. c.	1 c. c.
50 to 100 pounds	20 to 30 c. c.	1 c. c.
100 to 150 pounds	30 to 35 c. c.	1 c. c.
150 to 200 pounds	35 to 40 c. c.	1 c. c.
200 to 250 pounds	40 to 45 c. c.	1 c. c.
Over 300 pounds	60 to 70 c. c.	1 c. c.

In badly infected herds this dosage should always be slightly increased.

Do not give serum to a sick hog.

How to secure the serum.

In compliance with the state law in regard to the distribution of serum, all serum must be sent directly to the resident hog raiser.

FIG. 10.—Equipment necessary for immunizing.

Veterinarians who are using it for clients should have the client make application for the serum in his own name together with that of the veterinarian. The serum can not be secured without the signature of the veterinarian. Five hundred cubic centimeters, enough for about 20 shotes, weighing from 50 to 80 pounds, are distributed free of charge *only* upon properly signed application received from a hog owner when there is cholera present in his herd, or when his hogs are in immediate danger from the disease. A veterinarian must sign such applications or other suitable evidence must be given that the disease exists in the herd or is in the immediate vicinity. All applications for serum should be made out on blanks furnished for that purpose. These application

blanks may be obtained by writing to the Director of the Agricultural Experiment Station, Berkeley, California, to the Veterinary Department of the University of California, Berkeley, California, or to the State Veterinarian, Sacramento, California. Copies have been sent to the County Live Stock Inspectors in the various counties having such officials, and an effort has been made to place application blanks in the hands of as many hog raisers and veterinarians as possible.

In cases of emergency, when no application blanks are available, the form given on the last page of this bulletin may be filled out and sent to the Director of the Experiment Station, Berkeley, California. In cases where a night letter or a telegram is necessary, the following form should be used:

Veterinary Department, University of California,
Berkeley, California:

Send hog serum to

(Insert name of express office here)

for ____________ hogs, total weight __________________
(Number of hogs) (Total weight in pounds)

Before using serum, I agree to fill out, sign, and mail to you the application blanks furnished with serum. I am a resident of California.

(Signed) ____________________________
(Signature of owner of hogs)

Cost of the serum.

All serum is sold at actual cost of production, except that distributed free as provided by law. When the laboratory first began the preparation of hyper-immune serum the cost was approximated at 2½ cents per c.c., making the cost of treatment of a 50 to 60 pound shote about 50 cents. With a larger quantity of serum now being made and improved facilities for production established, it has been found that the cost of serum can be slightly decreased, and will be placed at 2 cents per c.c. after September 1, 1912. It is evident upon study of the method of making the serum, that a large number of hogs are consumed. The price of these varies as does the feed which is necessary for these animals. Competent veterinarians and assistants are necessary in order to produce a reliable product. Every effort is made toward the practice of economy and different methods are used which might reduce the cost of production and at the same time produce a potent serum. The use of normal salt solution placed in the abdominal cavity of the virus hogs a few hours before death and recovered at the time of killing, has given success and reduced the cost of making a hyper-immune. Virulent blood is collected from field outbreaks in justifiable cases.

Serum produced.

From September 1, 1912, to June 1, 1912, the Station has produced 600,000 c.c. of serum, which is enough to vaccinate 24,000 one hundred pound hogs. This has supplied the demand except in a few instances where a few days were required until the serum could be tested before it was shipped. To produce this amount of serum has required 174 hyper-immune hogs. To produce these hyper-immunes 230 susceptible hogs were used to secure the virulent blood. Two hundred thirteen thousand cubic centimeters or thirty-eight per cent of the serum has been distributed free of cost to the hog raisers according to the direction of the law.

Results of the serum in California.

Hog cholera has been reported and serum used in the following counties:

Alameda	Nevada	Shasta
Butte	Napa	San Joaquin
Colusa	Orange	Solano
Fresno	Placer	San Bernardino
Glenn	San Luis Obispo	Sutter
Imperial	Santa Cruz	San Mateo
Kings	Sacramento	Tulare
Kern	San Diego	Tehama
Los Angeles	Sonoma	Yolo

Only thirty-seven complete reports have been received of the outcome of the serum treatment in *infected* herds. The following table gives the summary of these results:

Number of herds.	Number of hogs treated.	Number that died after treatment, apparently well when treated.	Number dead at time application was made for serum.	Per cent of treated hogs that died.
37	2,760	363	813	13 + %

It must be remembered that these reports are from infected herds, the majority showing the acute type of the disease. Many of the 13 + per cent were no doubt infected and not yet showing visible symptoms when injected with the serum. Nine outbreaks out of the 37 were abruptly checked. The serum should not be wasted on *visibly* sick hogs.

Reports necessary.

Blank report forms are distributed with every order of serum but very few of them are returned to the Station with the data necessary. These reports are desired in order that the Station may have a record of the results of the serum treatment. These records are important because the serum is distributed directly to the hog raisers and the Station has no other way of determining whether the serum has been used properly and whether it is doing the good that is expected of it.

APPLICATION BLANK FOR ANTI-HOG CHOLERA SERUM.

To the Director of the Agricultural Experiment Station, TOWN__________
University of California, Berkeley, Cal.: DATE__________

SIR: I have read Circular No. 68 (or) Bulletin No. 229 (indicate which by underlining), issued by the Agricultural Experiment Station, University of California, and desire to have my hogs immunized with serum prepared by said Experiment Station.

I am a bona fide resident of the State of California and am actually engaged in hog raising.

My post office address is____
(Town) (County)

The total number of hogs on my premises is______________________________
Of which the number weighing less than 20 pounds that I wish to treat is__________
The number weighing from 20 to 50 pounds that I wish to treat is______________
The number weighing from 50 to 100 pounds that I wish to treat is______________
The number weighing from 100 to 150 pounds that I wish to treat is_____________
The number weighing from 150 to 200 pounds that I wish to treat is_____________
The number weighing from 200 to 250 pounds that I wish to treat is_____________
The number weighing over 300 pounds that I wish to treat is__________________
The total estimated weight of all my hogs that I wish to immunize is_____________

I understand that the Agricultural Experiment Station assumes no responsibility for the serum which it distributes further than that great care is exercised in its preparation and in testing it for potency before it leaves the laboratory.

I agree to report in writing, on blanks to be furnished with the serum, the results of the serum treatment of my hogs to the Director of the Experiment Station once each week for four consecutive weeks.

(Signed) ______________________________
(Owner of the hogs)

(If hog cholera exists in your herd or in the immediate neighborhood the following blanks should be filled in.)

Date of first indication of cholera in your herd______________________________
Date of first death from cholera in your herd_______________________________
Sizes of hogs that seem to be particularly affected___________________________
The approximate length of sicknesses_____________________________________
Number of hogs sick with cholera at the present time_________________________
Number of hogs that have died from cholera in the present outbreak______________
Has cholera existed on your premises before?__________ When?_______________

To the best of my knowledge the nearest infected hogs are____________________
miles distant from my premises, on the ranch of_____________________________,
whose post office address is____

I have reason to believe that my hogs are / are not in immediate danger from hog cholera.

Signature of owner of the hogs____
Signature of veterinarian who made the diagnosis of cholera____________________
Signature of veterinarian who is to administer the serum_______________________

(Make all checks, money orders, and drafts payable to the Regents of the University of California. Do not send cash in payment for serum.)